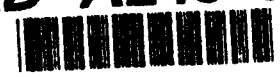

CRC Report No. 577

1990 CRC DRIVEABILITY WORKSHOP

October 1991

COORDINATING RESEARCH COUNCIL, INC.
219 PERIMETER CENTER PARKWAY, ATLANTA, GEORGIA 30346

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COORDINATING RESEARCH COUNCIL
INCORPORATED
219 PERIMETER CENTER PARKWAY
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1990 CRC DRIVEABILITY WORKSHOP

(CRC Project No. CM-118-90)

Prepared by the

CRC-Automotive Volatility Group

October 1991

Automotive Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

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APPENDICES

I. INTRODUCTION

A driveability workshop was sponsored by the Coordinating Research Council, Inc. (CRC) October 9-12, 1990, at Renegade Raceway in Yakima, Washington. The workshop was conducted in response to interest expressed by members of the CRC Volatility Group. Thirty-three raters, technicians, and engineers attended the workshop. Attendees are listed in Appendix A. Training was accomplished through a handout manual, seminars using the manual, discussions, and actual track testing.

II. OBJECTIVE

The objective of the workshop was actually four-fold. The first objective was to train novice driver-raters, and the second was to improve the skills of trained driver-raters in using the CRC Cold-Start and Warmup Driveability Procedure to make its interpretation within industry more uniform. The third objective was to introduce and document a uniform method to test manual transmission vehicles with the CRC procedure. The fourth objective of the workshop was to provide interpretations and definitions of the terminology used in the procedure to develop more uniform use of the terms within industry. An additional objective of the workshop was to identify areas in the procedure which required updating or revising.

Since the workshop was to be an educational experience rather than a source of driveability data, emphasis was placed upon exchange of information as opposed to data collection and analysis. The intent of the workshop was not to "rate the raters," but to reduce the laboratory-to-laboratory variations in the application of the CRC Cold-Start and Warmup Driveability Procedure and the related terminology.

III. TEST VEHICLES

Twenty-seven vehicles were used for training and track testing. As indicated in Table 1, the vehicles were selected to provide a variation in manufacturers, engine sizes, fuel system types, and transmissions. Six of the vehicles were "rigged" to demonstrate types of malfunctions and levels of severity. "Rigging" these vehicles allowed their use over and over again throughout the day to allow rotation of all the training crews through the entire complement of vehicles, with no change in malfunctions or severity. The remaining twenty-one vehicles were used for the crews to run mock tests to practice the cycle and evaluate each other's execution of the maneuvers in the procedure. Later in the week, these vehicles were used to allow each participant the opportunity to actually conduct a cold-start and warmup test after an overnight soak.

IV. TEST FUEL

The fuel was blended for especially poor performance during the cold-start and warmup testing. Although it was not necessary to use specially-blended fuels in the "rigged" demonstration vehicles, all vehicles were drained prior to the workshop and refueled with the test fuel. Inspection data furnished by the fuel supplier are given in Table 2.

V. TEST PROGRAM

The workshop was conducted October 9-12, 1990, at Renegade Raceway in Yakima, Washington. The timing of the workshop was such that the results and benefits would be available for the CRC Customer/Rater Driveability Program being conducted in early 1991.

The workshop was planned to accommodate all levels of experience. Test crews were assigned with mixed levels of experience; there were six crews of five people each, and each crew was rotated among six trainers. Instructions were given both in driving/rating, and in being an observer/data recorder. In order to maximize the exchange of information, participants from different companies were assigned to work together and were encouraged to discuss informally the different ways they conduct driveability ratings. A meeting was held for the training personnel prior to the workshop so that training could be done in a uniform manner.

A procedure for rating manual transmission vehicles was developed prior to the workshop and presented during the workshop. It was not mandatory that all participants practice the manual transmission procedure; however, there were seven manual transmission vehicles available for those wishing to learn and practice the procedure.

The first two days of the workshop were devoted to training, discussion, practice of the test cycle on the test vehicles, and demonstration using the "rigged" vehicles. The last two mornings of the workshop were used for actual cold-start and warmup tests. Each participant had the opportunity to be a driver-rater and each participant had the opportunity to be an observer on both days. A trainer rode with each crew during the tests.

The program proposal, including an agenda of the workshop, is provided in Appendix B. The automatic transmission procedure, manual transmission procedure, definitions, and data sheets used as the basis for training are in Appendix C.

VI. DATA ANALYSIS

This report contains no analysis of the driveability data obtained during the workshop, because the data do not offer any information about the operation or success of the workshop. The workshop was designed to improve the application of the CRC Cold-Start and Warmup Driveability Procedure, and its success was the clarification of the technique to the participants and the increased consistency of driveability results expected in the future.

The individual data sheets obtained from the two days of cold-start testing were reviewed on-site shortly after their completion. This review was concerned with the proper completion of the form, and served as the basis for discussion. Trainers riding with the test crews were also able to offer input and advice following the completion of the practice tests, but rode only as observers on the actual cold-start testing the last two days.

VII. CONCLUSIONS

The first two objectives of this workshop, to train novice driver-raters and to improve the skills of trained driver raters, were met. Although not every attendee left the workshop with the same caliber of expertise at performing as driver-raters, all attendees left the workshop as experienced driver-raters, and developed a greater level of expertise through the classroom training and the on-track experience. The third objective, to introduce a uniform method to rate manual transmission vehicles, was accomplished through the handout that contained the written procedure on performing the ratings with a manual transmission vehicle. This procedure has now become part of the CRC driveability procedure. Regarding the fourth objective, terminology associated with driveability rating was explained and discussed during the workshop, resulting in more uniform use of the terminology. Questions regarding conduct and application of the procedure were discussed and answered. The consensus of the attendees was that the participants, including the trainers, left the workshop with a clearer understanding of the procedure and its intent. There were no revisions to the procedure proposed because a subsequent program is already scheduled to investigate the correlation of the procedure to the customer.

VIII. RECOMMENDATIONS FOR FUTURE RATING WORKSHOPS

The consensus of the participants was that this first driveability rating workshop was of great benefit and should be held as often as practical. A duration of four days was successful. There seemed to be a good distribution of classroom discussion time and track time. Mixing raters from different companies for the track work was a success. The meeting among the trainers prior to the workshop was beneficial both for uniformity in training and to assist in identifying issues to be covered. Conducting the actual cold-start tests was of much assistance to the participants by allowing them to assimilate all they had learned for practical use.

TABLE 1

Test Vehicles

Year	Make and Model	Engine Size, Liters	Fuel System*	Transmission
1986	Nissan Maxima	3.0	PFI	Manual
1990	Chevrolet Lumina	3.1	PFI	Automatic
1989	Oldsmobile Ciera	2.5	TBI	Automatic
1990	Dodge Caravan	3.0	PFI	Automatic
1990	Subaru Legacy	2.2	PFI	Manual
1989	Honda Prelude	2.0	PFI	Manual
1989	Toyota Tercel	1.5	Carb	Automatic
1988	Jeep Wagoneer	5.9	Carb	Automatic
1989	Honda Civic	1.5	TBI	Automatic
1989	Pontic Bonneville	3.8	PFI	Automatic
1989	Plymouth Acclaim	2.5	TBI	Automatic
1989	Dodge Spirit	2.5	TBI	Automatic
1989	Dodge Dynasty	2.5	TBI	Automatic
1988	Plymouth Reliant	2.2	TBI	Automatic
1988	Chevrolet Nova	1.6	Carb	Manual
1988	Chrysler New Yorker	3.0	PFI	Automatic
1988	Honda Accord	2.0	Carb	Manual
1987	Chevrolet Astro	4.3	TBI	Automatic
1987	Oldsmobile Delta 88	3.8	PFI	Automatic
1986	Ford Thunderbird	3.8	TBI	Automatic
1985	Chrysler New Yorker	2.6	Carb	Automatic
1987	Chevrolet Blazer	2.8	TBI	Manual
1986	Buick Century	2.5	TBI	Automatic
1985	Dodge 600	2.6	Carb	Automatic
1985	Chevrolet Celebrity	2.8	Carb	Automatic
1989	Ford Escort	1.9	TBI	Automatic
1989	Toyota Camry	2.0	PFI	Manual

* PFI = Port-Fuel-Injected
TBI = Throttle-Body-Injected
Carb = Carbureted

TABLE 2

Supplier's Fuel Inspections

Distillation, °F	
IBP	89
5% Evap.	119
10% Evap.	137
20% Evap.	166
30% Evap.	198
40% Evap.	231
50% Evap.	259
60% Evap.	280
70% Evap.	301
80% Evap.	321
90% Evap.	345
95% Evap.	363
End Point	414
RVP, psi	7.2
API Gravity	51.3
Research Octane Number	98.0
Motor Octane Number	86.6

APPENDIX A

WORKSHOP PARTICIPANTS

PARTICIPANTS IN THE

1990 CRC DRIVEABILITY WORKSHOP

NAME	COMPANY
Chuck Valade, Leader	Chrysler Motors Corporation
Richard Allen	Carter Automotive
Harold "Archie" Archibald	BP Oil
Rob Boom	Chevron Research & Technology Co.
George Budzinski	BP Oil
Tabb Buel	Phillips Petroleum Company
Richard Campos	Toyota Technical Center
Ed Carhart	Texaco
Pat Costello	Mobil Research & Development Corp.
Richard Dunn	Carter Automotive
Beth Evans	Coordinating Research Council, Inc.
John Graham	Chevron Research & Technology Co.
Dave Hansen	General Motors Research Laboratories
Trude Helfrich	Toyota Technical Center
Bruce Henderson	Amoco Oil Company
Roy Hoppe	Shell Canada
Jack Hutchens	Shell Development Company
Joe Johnson	Texaco
Jill Kaplan	Auto Research Laboratories, Inc.
Doug McCorkell	Unocal Corporation
Andy Matulek	Carter Automotive
Mike Patterson	NIPER
Stan Pilling	Sun Refining & Marketing Company
Mike Ragomo	Mobil Oil Corporation
Doug Rathe	Shell Development Company
Bob Reuter	Texaco
Mile Rivenburgh	EG&G Automotive Research
Charlie Sherwood	Ford Motor Company
Steve Simms	Amoco Oil Company
Joe Staudt	Southwest Research Institute
Ron Wise	Ford Motor Company
Jim Wooten	Phillips Petroleum Company
Jim Zivic	Carter Automotive

APPENDIX B

PROGRAM FOR THE 1990
CRC COLD-START AND WARMING-UP
DRIVEABILITY WORKSHOP

PROGRAM FOR THE 1990 CRC COLD-START AND WARMING-UP DRIVEABILITY WORKSHOP

BACKGROUND

During the past few years, there has been a decline within Industry of experienced trained driver-raters for driveability work. This deficit was most apparent during the 1989 CRC Driveability Program, when requests had to be made to various companies that they train personnel specifically for rating, because there were not enough driver-raters already available to cover the needs of the program. The cooperation of those companies was greatly appreciated.

Although this dilemma provided the obvious impetus for conducting a driveability workshop, there are other equally important issues which must be addressed. It has been recognized for many years that some driver-raters are more sensitive or severe than others. It has been necessary in each program design and analysis to make provision for this fact, and driver-rater severity factors have been developed and applied to the data. At times, such factors have been large, and the propriety of such adjustments is open to serious question. It would be far better to have a staff of trained driver-raters that observe and rate malfunctions uniformly, thus minimizing the need for driver-rater correction factors. With changes in personnel due to retirements and job reassignments, there is a general lack of prior driveability experience. The net result is that driver-raters are not agreeing on what certain malfunctions are called; e.g.,some will call a malfunction a stumble, while others will call it a surge. There is a lack of agreement on the level of severity; e.g., what some will call moderate, others will call heavy. The inclusion of manual transmission vehicles in the programs requires that a method for rating them be developed. New technology within the vehicles has created a potential need to update the CRC Cold-Start and Warmup Driveability Procedure.

It was thus determined that a driveability workshop should be held during the fall of 1990, in order that experienced personnel would be available for participation in the Customer/Rater Driveability Program being conducted January through March 1991.

OBJECTIVE

The objective of this Workshop is to improve the application of the CRC Cold-Start and Warmup Driveability Procedure and provide uniform interpretation of definitions associated with the Procedure. This includes training novice driver-raters, improving the skills of trained driver-raters, presenting a method to rate manual transmission vehicles, and developing more uniform use of terminology within the Industry. It is also anticipated that the Workshop will identify areas in the procedure which require updating or revising.

SCOPE AND TIMING

Training will be accomplished through seminars, discussions, and demonstrations, and verified with actual track testing using rating techniques and equipment. All participants will have the opportunity to learn to distinguish among types of malfunctions and severity levels, and all participants will be given hands-on training and experience. Training will be geared to train inexperienced personnel, as well assist experienced driver-raters with improvement and refinement of their skills.

FACILITIES

The Workshop will be held at Renegade Raceway in Yakima, Washington. This facility has a level, paved, 3900-foot-by-65-foot asphalt drag strip, with a staging area for parking vehicles for overnight soaks. The 1989 CRC Driveability Program was successfully conducted at this facility, with maximum cooperation from the owners.

VEHICLES

An appropriate number of vehicles will be rented to accommodate the participation in the Workshop. There will be two fleets of vehicles available for training. The first fleet will be "rigged" to demonstrate types of malfunctions and levels of severity. This fleet can be used over and over again to allow rotation of the crews throughout the entire complement of vehicles. The second fleet will be available for use later in the week to allow each participant the opportunity to actually conduct a cold-start and warmup test after an overnight soak. This fleet will only be available for use one time per day.

FUELS

It will not be necessary to use specially-blended fuels in the "rigged" fleet of vehicles; however, fuels blended for especially poor performance will be used in the "cold-start" fleet.

WORKSHOP SCHEDULE

The Workshop will be conducted from Tuesday through Friday. Monday will be used for preparation of training personnel. The tentative agenda is as follows:

Tuesday Morning	-	Classroom Discussion
Tuesday Afternoon	-	Track Training
Wednesday Morning	-	Classroom Discussion
Wednesday Afternoon	-	Track Training
Thursday (All Day)	-	Track Training (Use of Cold-Start Fleet in Morning Only)
Friday Morning	-	Track Training (Use of Cold-Start Fleet in Morning Only)
Friday Afternoon	-	Classroom Discussion

It should be emphasized that this is a tentative schedule, and is subject to adjustment on-site.

PARTICIPATION

The Workshop has been planned to accommodate all levels of experience. Test crews will be assigned with mixed levels of experience, with at least one well-experienced person per crew. Crews will be changed daily, or as appropriate, in order to maximize the exchange of information. Training personnel will be rotated through the crews as necessary.

APPENDIX C

WORKSHOP TRAINING
PROCEDURES, DEFINITIONS,
AND DATA SHEETS

CRC COLD START AND WARMUP DRIVEABILITY PROCEDURE AUTOMATIC TRANSMISSION VEHICLES

TEST PROCEDURE AND DATA RECORDING

A. Record all necessary test information at the top of the data sheet.

B. Start engine per Owner's Manual Procedure. Record start time.

C. If engine fails to start in 15 seconds of cranking, stop cranking and follow Owner's Manual Starting Procedure and crank for an additional 15 seconds. If the engine still fails to start mark the data sheet no start and start the vehicle by any means possible.

D. Record idle quality in "Neutral" or "Park" immediatly after start; foot should removed from the accelerator pedal.

E. If the engine stalls, repeat steps B and C. Record the number of stalls and the restart time. If the vehicle was a no start on the first start no times are required on restarts but number of stalls is required.

F. Allow engine to idle 15 seconds. Apply brake with right foot, shift to normal drive range and record idle quality. If the engine stalls, restart immediatly. Don't record start times, just the number of stalls. Idle 5 seconds in "Drive".

G. After 5 seconds in "Drive" (step F), make a light throttle (Lt.Th) acceleration from 0-25 mph for .1 mile at a constant throttle opening beginning at the predetermined manifold vacuum. Cruise at 25 mph for .1 mile. At the .2 mile marker open the throttle to the detent position and accelerate from 25 to 35 mph at a constant throttle opening. Stop at the .3 mile marker and make a 0 to 35 WOT acceleration. At the .4 mile marker decelerate to 10 mph and then accelerate at light throttle from 10 to 25 mph.

NOTE: Definitions of light throttle, detent, WOT accelerations and manifold vacuum settings are attached.

H. At the .5 mile marker, brake moderately to a stop on the right side of the track. Idle for 30 seconds in drive. Record idle quality and number of stalls. Don't record restart times.

I. Perform steps G and H three times for a total of 1.5 miles. The mile marker for the beginning of each maneuver is indicated on the data sheet.

J. At mile marker 1.5, after completing the 30 second idle, make a crowd acceleration (constant predetermined vacuum) from 0 to 45 mph. Four-tenths of a mile is provided for this maneuver. Decelerate from 45 mph to 25 mph at the 1.9 mile marker, and open the throttle to the detent position and accelerate from 25 to 35 mph. At the 2.0 mile marker stop and accelerate at WOT from 0 to 35 mph. At the 2.1 mile marker decelerate to 10 mph and perform a light throttle acceleration from 10 to 25 mph. Stop at the 2.2 mile marker and idle in drive for 30 seconds.

K. Perform step J three times. Appropriate mile markers for the start of each maneuver are shown on the data sheet.

L. During the above maneuvers, observe and record the severity of any of the following malfunctions (see attached definitions):

1. Hesitation
2. Stumble
3. Surge
4. Accel Stall
5. Decel Stall
6. Backfire

Record maneuvering stalls on the data sheet in the appropriate column: Ac Stall is acceleration stalls and Dc Stall is deceleration stalls. The Dc Stall should be recorded at the end of the maneuver. For example, after the 25 to 35mph detent acceleration you have to decelerate to a stop to perform the 0 to 35 WOT maneuver. If the vehicle stalls on the decel the stall would be recorded with the 25 to 35 detent maneuver.

CRC COLD START AND WARMUP DRIVEABILITY PROCEDURE MANUAL TRANSMISSION VEHICLES

TEST PROCEDURE AND DATA RECORDING

A. Record all necessary test information at the top of the data sheet.

B. Start engine per Owner's Manual Procedure. Record start time.

C. If engine fails to start in 15 seconds of cranking, stop cranking and follow Owner's Manual Starting Procedure and crank for an additional 15 seconds. If the engine still fails to start mark the data sheet no start and start the vehicle by any means possible.

D. Record idle quality in "Neutral" with the clutch out immediately after start; foot should be removed from the accelerator pedal.

E. If the engine stalls, repeat steps B and C. Record the number of stalls and the restart time. If the vehicle was a no start on the first start no times are required on restarts but number of stalls is required.

F. Allow engine to idle 15 seconds. Push in the clutch and shift to first gear and record idle quality. If the engine stalls, restart immediately.Don't record start times, just the number of stalls. Idle 5 seconds in "First".

G. After 5 seconds in "First" (step F), make a light throttle (Lt.Th) acceleration from 0-25 mph for .1 mile at a constant throttle opening beginning at the predetermined manifold vacuum with the transmission in "Second Gear". Shift to "High"(1:1) Gear and cruise at 25 mph for .1 mile. At the .2 mile marker open the throttle to the detent position and accelerate from 25 to 35 mph at a constant throttle opening. Stop at the .3 mile marker and make a 0 to 35 WOT acceleration. At the .4 mile marker decelerate to 10 mph and then accelerate at light throttle from 10 to 25 mph the transmission should be in "Second Gear" for this maneuver.

NOTE: Definitions of light throttle, detent, WOT accelerations and manifold vacuum settings are attached.

H. At the .5 mile marker, brake moderately to a stop on the right side of the track. Idle for 30 seconds in first. Record idle quality and number of stalls. Don't record restart times.

I. Perform steps G and H three times for a total of 1.5 miles. The mile marker for the beginning of each maneuver is indicated on the data sheet.

J. At mile marker 1.5, after completing the 30 second idle, make a crowd acceleration (constant predetermined vacuum) from 15 to 45 mph in third gear. Four-tenths of a mile is provided for this maneuver. Decelerate from 45 mph to 25 mph at the 1.9 mile marker, and open the throttle to the detent position and accelerate from 25 to 35 mph in high gear(1:1). At the 2.0 mile marker stop and accelerate at WOT from 10 to 35 mph. At the 2.1 mile marker decelerate to 10 mph and perform a light throttle acceleration from 10 to 25 mph. Stop at the 2.2 mile marker and idle for 30 seconds.

K. Perform step J three times. Appropriate mile markers for the start of each maneuver are shown on the data sheet.

L. During the above maneuvers, observe and record the severity of any of the following malfunctions (see attached definitions):

1. Hesitation
2. Stumble
3. Surge
4. Accel Stall
5. Decel Stall
6. Backfire

Record maneuvering stalls on the data sheet in the appropriate column: Ac Stall is acceleration stalls and Dc Stall is deceleration stalls. The Dc Stall should be recorded at the end of the maneuver. For example, after the 25 to 35mph detent acceleration you have to decelerate to a stop to perform the 10 to 35 WOT maneuver. If the vehicle stalls on the decel the stall would be recorded with the 25 to 35 detent maneuver.

DEFINITIONS AND EXPLANATIONS

TEST RUN

Operation of a vehicle throughout the prescribed sequence of operating conditions and/or maneuvers for a single test fuel.

MANEUVER

A specified single vehicle operation or change of operating conditions (such as idle,acceleration or cruise) that constitutes one segment of the driveability driving schedule. Each maneuver will be given a start mile marker position and an allotted distance to perform the evaluation. Some maneuvers may not require the total allotted distance to evaluate but the next maneuver should not be attempted until reaching the prescribed mile marker.

CRUISE

Operation at a prescribed constant vehicle speed with a fixed throttle position on a level road.

STALL

Any occasion during a test when the engine stops with the ignition on. The types of stalls are:

IDLE STALL- This is any stall that is experienced when the vehicle is not in motion, or when a maneuver is not being attempted.

ACCELERATION STALL-This is any stall that is experienced during a prescribed maneuver or an attempted maneuver where the throttle is at any position other than the idle position.

DECELERATION STALL-This is any stall that is experienced while the vehicle is moving but the throttle is at the idle position. Heavy braking can induce a stall, that is not part of this drive procedure, for this reason all braking to get ready for the next maneuver should be light to moderate.

IDLE ROUGHNESS
An evaluation of the idle quality or degree of smoothness while the engine is idling. In all the idle maneuvers, the 5,15 and 30 second, the number of idle stalls is to be recorded but after the allotted time is reached or 4 stalls are recorded continue to the next maneuver.

BACKFIRE
An explosion in the induction or exhaust system. This should be rated not counted.

HESITATION
A temporary lack of vehicle response to the opening of the throttle.

STUMBLE
A short, sharp reduction in the acceleration after the vehicle is in motion.

SURGE
A cyclic power fluctuation occurring during acceleration or cruise.

NO-START
When the vehicle fails to fire and run after two starting attempts of 15 sec. each.

FALSE-START
When the rater inadvertently stops cranking before the vehicle has actually started. If this happens the time for this False-start should be added to the next full start.

MALFUNCTION SEVERITY RATINGS

The number of stalls encountered during any maneuver are to be listed in the appropriate data sheet column including any decel stalls at the end of the maneuver getting ready for the next maneuver. Each of the other malfunctions must be rated by severity and the letter designation entered on the data sheet. The following definitions of severity are to be applied in making such ratings.

TRACE (T)- A level of malfunction severity that is just discernible to a trained rater but generally not to most drivers.

MODERATE (M)- A level of malfunction severity that is probably noticeable to the average driver.

HEAVY (H)- A level of malfunction severity that is pronounced and obvious to any driver.

Enter the T,M, or H in the appropriate data block to indicate both the occurrence of the malfunction and its severity. More than one type of malfunction may be recorded on each line. If no malfunctions occurs, enter a dash (-) to indicate that the maneuver was performed and the operation was satisfactory during the maneuver.

EXPLANATIONS OF MANEUVERS
AUTOMATIC VEHICLES

WIDE OPEN THROTTLE (WOT) ACCELERATION

"Floorboard" acceleration from 0 to 35 mph through the gears. The rate at which the throttle is to be depressed is to be as fast as possible without producing tire squeal or appreciable slippage.

PART-THROTTLE (PT) ACCELERATIONS

An acceleration made at any defined throttle position, or consistent change in throttle position, less than wot. Several part throttle accelerations are used. They are:

LIGHT THROTTLE (LT TH) - All light throttle accelerations are begun by opening the throttle to an initial manifold vacuum and maintaining constant throttle position throughout the remainder of the acceleration. The 0-25 maneuver must be completed in .1 mile in 9 seconds. The selected vacuum is posted in each vehicle.

CROWD - An acceleration made at a constant manifold vacuum. To maintain constant vacuum, the throttle opening must be continuously increased with increasing engine RPM.

DETENT - All detent accelerations are begun by opening the throttle to a point just before the transmission would downshift and holding that throttle position throughout the acceleration up to 35 mph. The manifold vacuum corresponding to this point at 25 mph is posted in the vehicle.

EXPLANATIONS OF MANEUVERS
MANUAL VEHICLES

WIDE OPEN THROTTLE (WOT) ACCELERATION

"Floorboard" acceleration from 10 to 35 mph. The test procedure is to take off light throttle in first gear and accelerate up to 15 mph. At 15 shift to second gear, then with the clutch out and the throttle closed decelerate to 10 mph and floor the accelerator. Run the vehicle in second gear up to 35 mph. If 35 mph is too high an rpm in second then run the test to 30 mph.

PART-THROTTLE (PT) ACCELERATIONS

An acceleration made at any defined throttle position, or consistent change in throttle position, less then wot. Several part throttle accelerations are used. They are:

LIGHT THROTTLE (LT TH) 0 to 25 MPH - Take off very light throttle and accelerate to between 8 - 10 mph. Shift to second gear. Then with the clutch out decelerate to 5 mph with the throttle closed. At 5 mph accelerate at the light throttle vacuum setting up to 25 mph. All light throttle accelerations are performed by opening the throttle to an initial manifold vacuum setting then maintaining constant throttle position throughout the remainder of the maneuver.

LIGHT THROTTLE 10 TO 25 MPH - These are performed after the 0 - 35 WOT maneuver so the transmission is in second gear. Decelerate with the clutch out in second and the throttle closed to 10 mph then accelerate at the light throttle vacuum up to 25 mph.

CROWD - An acceleration made at a constant manifold vacuum. To maintain constant vacuum, the throttle opening must be continuously increased with increasing engine RPM. The maneuver is performed by first taking off very light throttle and accelerating up and shifting the transmission until the vehicle is in third gear. Then decelerate with the clutch out and the throttle closed to 15 mph. At 15 mph accelerate at the posted vacuum up to 45 mph.

DETENT - All detent accelerations are performed after the 25 mph cruise and the transmission should be in high gear (1:1). The throttle should be opened to approximately 3/4 throttle and held constant until the vehicle reaches 35 mph. The initial manifold vacuum for 3/4 throttle at 25 mph will be posted in the vehicle.

METHOD FOR CALCULATING TOTAL WEIGHTED DEMERITS (TWD)

Demerits for Poor Starting:

Demerits = Total Starting Time - 2

Demerits for Stalls:

DEmerits = (No. of Idle Stalls) x 8 + (No. of Maneuvering Stalls) x 32

Demerits for Malfunctions Rated Subjectively are:

Demerits for Subjective Ratings are:

Trace	= 1
Moderate	= 2
Heavy	= 4

Weighting Factors for Each Malfunction are:

Idle Roughness	= 1
Surge	= 4
Hesitation	= 6
Stumble	= 6
Backfire	= 6

Weighted Demerits = Demerits x Weighting Factor

Total Weighted Demerits is:

TWD = Weighted Demerits + Demerits for Stalls + Starting Demerits

NOTE: When more than one malfunction occurs in a driving maneuver, only the malfunction giving the highest weighted demerits is counted.

CRC Driveability Data Sheet

Run no.	Car	Fuel	Rater	Date	Time	Temperatures: Soak	Run	Fuel tank	X1	X2

Starting time, sec.				Idle N.	Idle Dr.
Initial	Restart 1	Restart 2	Restart 3	Ruf. stalls	Ruf. stalls

0.0 0-25 Lt. Th.							0.1 25 Cruise							0.2 25-35 Detent							0.3 0-35 WOT							0.4 10-25 Lt. Th.							0.5 Idle	Temperatures		
	Stalls							Stalls							Stalls							Stalls							Stalls										
Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Ruf. stalls	Fuel tank	X1	X2
0.5							0.6							0.7							0.8							0.9							1.0				
1.0							1.1							1.2							1.3							1.4							1.5				

1.5 0-45 Crowd							1.9 25-35 Detent							2.0 0-35 WOT							2.1 10-25 Lt. Th.							2.2 Idle	Temperatures			
	Stalls							Stalls							Stalls							Stalls											
Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Hes.	Stm.	Srg.	Bkt.	Ac	Dc		Ruf. stalls	Fuel tank	X1	X2
2.2							2.6							2.7							2.8							2.9					Sample no.
2.9							3.3							3.4							3.5							3.6					
3.6							4.0							4.1							4.2							4.3					
4.3							4.7							4.8							4.9							5.0					

Comments: _____

CRC Driveability Data Sheet - Manual Transmissions

Run no. | Car | Fuel | Rater | Date | Time | Temperatures: Soak | Run | Fuel tank | X1 | X2

Starting time, sec.: Initial | Restart 1 | Restart 2 | Restart 3

Idle N. Ruf. stalls | Idle Dr. Ruf. stalls

0.0 0-25 Lt. Th. 5-25 2nd	0.1 25 Cruise 25 4th	0.2 25-35 Detent Detent 4th	0.3 0-35 WOT 10-35 WOT 3rd	0.4 10-25 Lt. Th. 10-25 2nd	0.5 Idle Idle in 1st
Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Ruf. stalls / Temperatures: Fuel tank, X1, X2
0.5	0.6	0.7	0.8	0.9	1.0
1.0	1.1	1.2	1.3	1.4	1.5

1.5 0-45 Crowd 15-45 3rd	1.9 25-35 Detent Detent 4th	2.0 0-35 WOT 10-35 WOT 3rd	2.1 10-25 Lt. Th. 10-25 2nd	2.2 Idle Idle in 1st
Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Hes. Stm. Srg. Brk. Ac Dc Stalls	Ruf. stalls / Temperatures: Fuel tank, X1, X2
2.2	2.6	2.7	2.8	2.9
2.9	3.3	3.4	3.5	Sample no.
3.6	4.0	4.1	4.2	4.3
4.3	4.7	4.8	4.9	5.0

Comments: _____